Revised ~~4/30/03~~11/1/03

STELLER SEA LION (*Eumetopias jubatus*): Western U. S. Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Steller sea lions range along the North Pacific Rim from northern Japan to California (Loughlin et al. 1984), with centers of abundance and distribution in the Gulf of Alaska and Aleutian Islands, respectively. The species is not known to migrate, but individuals disperse widely outside of the breeding season (late May-early July), thus potentially intermixing with animals from other areas. Despite the wide ranging movements of juveniles and adult males in particular, exchange between rookeries by breeding adult females and males (other than between adjoining rookeries) appears low (NMFS 1995); however, resighting data from branded animals have not yet been analyzed.

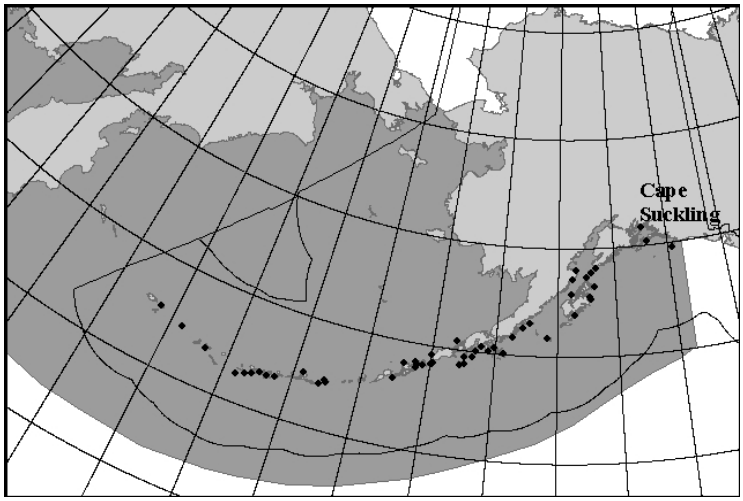

Figure 1. Approximate distribution of Steller sea lions in the eastern North Pacific (shaded area). Major haulouts and rookeries are also depicted (points).

Loughlin (1997) considered the following information when classifying stock structure based on the phylogeographic approach of Dizon et al. (1992): 1) Distributional data: geographic distribution continuous, yet a high degree of natal site fidelity and low (<10%) exchange rate of breeding animals between rookeries; 2) Population response data: substantial differences in population dynamics (York et al. 1996); 3) Phenotypic data: unknown; and 4) Genotypic data: substantial differences in mitochondrial DNA (Bickham et al. 1996). Based on this information, two separate stocks of Steller sea lions are now recognized within U. S. waters: an eastern U. S. stock, which includes animals east of Cape Suckling, Alaska (144°W), and a western U. S. stock, which includes animals at and west of Cape Suckling (Loughlin 1997, Fig. 1).

POPULATION SIZE

The most recent comprehensive estimate (pups and non-pups) of Steller sea lion abundance in Alaska is based on aerial surveys of non-pups in June 2002 and ground based pup counts in June and July of 2001 and 2002 (NMML unpublished data). Data from these surveys represent actual counts of pups and non-pups at all rookeries and major haulout sites in Alaska. During the 2002 survey, a total of 26,599 non-pups were counted at 259 rookeries and haul-out sites; 13,010 in the Gulf of Alaska and 13,589 in the Bering Sea/Aleutian Islands (NMML unpublished data). A composite pup count for 2001 and 2002 includes counts from 34 sites in 2002 and from nine sites in 2001. There were 3,884 pups counted in the Gulf of Alaska and 4,711 pups counted in the Bering Sea/Aleutian Islands for a total of 8,595 for the stock. Combining the pup count data from 2001 to 2002 (8,595) and non-pup count data from 2002 (26,599) results in a minimum abundance estimate of 35,194 Steller sea lions in the western U.S. stock in 2001-2002.

Minimum Population Estimate

The 2002 count of non-pups (26,602) plus the number of pups in 2000-2001 (8,177) is 34,779, which will be used as the minimum population estimate (N_{MIN}) for the western U. S. stock of Steller sea lion (Wade and Angliss 1997). This is considered a minimum estimate because it has not been corrected to account for animals which were at sea during the surveys.

Current Population Trend

The first reported trend counts (an index to examine population trends) of Steller sea lions in Alaska were made in 1956-60. Those counts indicated that there were at least 140,000 (no correction factors applied) sea lions in

the Gulf of Alaska and Aleutian Islands (Merrick et al. 1987). Subsequent surveys indicated a major population decrease, first detected in the eastern Aleutian Islands in the mid-1970s (Braham et al. 1980). Counts from 1976 to 1979 indicated about 110,000 sea lions (no correction factors applied, Table 1). The decline appears to have spread eastward to the Kodiak Island area during the late 1970s and early 1980s, and then westward to the central and western Aleutian Islands during the early and mid-1980s (Merrick et al. 1987, Byrd 1989). The greatest declines since the 1970s occurred in the eastern Aleutian Islands and western Gulf of Alaska, but declines also occurred in the central Gulf of Alaska and central Aleutian Islands. More recently, counts of Steller sea lions at trend sites for the western U. S. stock decreased 40% from 1990 to 2000 (Table 1). Counts at trend sites during 2000 indicate that the number of sea lions in the Bering Sea/Aleutian Islands region has declined 10.2% between 1998 and 2000. From 1991-00, an average annual decline of 5.4% in non-pup counts at trend sites was reported by Loughlin and York (2000).

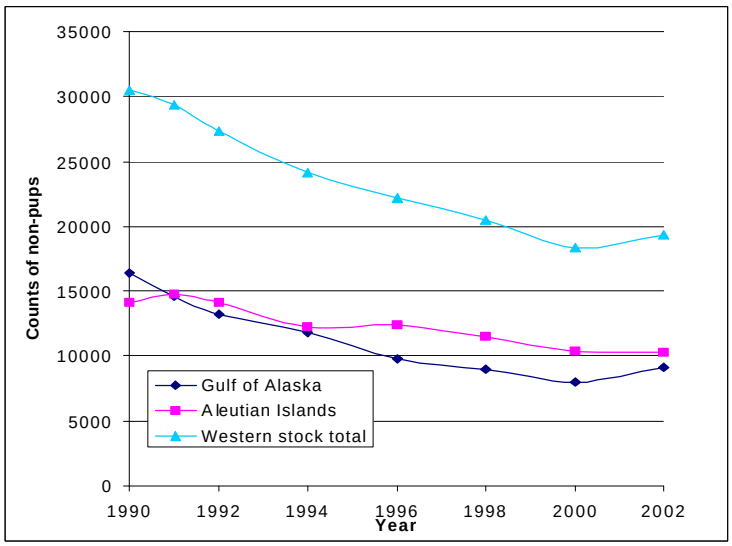

Figure 2. Counts of adult and juvenile Steller sea lions at rookery and haulout trend sites throughout the range of the western U.S. stock, 1990-2002.

Most recently, counts of non-pup Steller sea lions at trend sites for the western U.S. stock increased 5.5% from 2000 to 2002. This was the first region-wide increase for the western stock since standardized surveys began in the 1970s. However, the 2002 count was still 5.4% below the 1998 count and 36.7% below the 1990 count. The count for trend sites in the Gulf of Alaska increased 13.7% from 2000 to 2002, whereas those in the Aleutian Islands showed equivocal change (down 0.8%). The long-term, average decline for 1990-02 is 4.3% per year (NMML unpublished data).

Table 1. Counts of adult and juvenile Steller sea lions observed at rookery and haulout trend sites by year and geographical area for the western U. S. stock from the late 1970s through 1998 (NMFS 1995, Sease et al. 2001, NMML unpublished data). Counts from 1976 to 1979 (NMFS 1995) were combined to produce complete regional counts which are comparable to the 1990-02 data. The asterisk identifies 637 non-pups counted at six trend sites in 1999 in the eastern Gulf of Alaska which were not surveyed in 1998.

Area	late 1970s	1990	1991	1992	1994	1996	1998	2000	2002
Gulf of Alaska	65,296	16,409	14,598	13,193	11,862	9,784	8,937*	7,995	9,097
Bering Sea/Aleutians	44,584	14,116	14,807	14,106	12,274	12.426	11,501	10,330	10,250
Total	109,880	30,525	29,405	27,299	24,136	22,210	20,438*	18,325	19,337

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

There are no estimates of maximum net productivity rate for Steller sea lions. Hence, until additional data become available, it is recommended that the theoretical maximum net productivity rate (R_{MAX}) for pinnipeds of 12% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. However, it should be noted that the PBR management approach was developed with the understanding that direct human-related mortalities would be the primary reason for observed declines in abundance for marine mammal stocks in U. S. waters. For at least this stock, this assumption seems unwarranted. The recovery factor (F_R) for this stock is 0.1, the default value for stocks listed as "endangered" under the Endangered Species Act (Wade and Angliss 1997). Thus, for the western U. S. stock of Steller sea lions, PBR = 209 animals (34,779 × 0.06 × 0.1).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Six different commercial fisheries operating within the range of the western U. S. stock of Steller sea lions were monitored for incidental take by fishery observers during 1990-99: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. No sea lion mortality was observed by fishery observers in either pot fishery since 1990, nor in the BSAI longline fisheries during the past 5 years. For the fisheries with observed takes, the range of observer coverage over the 9-year period, as well as the annual observed and estimated mortalities, are presented in Table 2a. The mean annual (total) mortality for the most recent 5-year period was 9.6(CV = 0.10) for the Bering Sea groundfish trawl fishery, 0.6 (CV = 0.6) for the Gulf of Alaska groundfish trawl fishery, and 1.2 (CV = 0.9) for the Gulf of Alaska groundfish longline fishery. In 1996 (66% observer coverage), only 2 of the 4 observed mortalities in the Bering Sea trawl fishery occurred during monitored hauls, leading to an underestimate (3) of the extrapolated mortality for that fishery. As a result, 4 mortalities were used as both the observed and estimated mortalities for that year (Table 2a). The observed mortality in the 1993 Bering Sea longline fishery (30% observer coverage) also occurred during an unmonitored haul and therefore could not be used to estimate mortality for the entire fishery. Therefore, 1 mortality was used as both the observed mortality and estimated mortality in 1993 for that fishery, and should be considered a minimum estimate.

Observers also monitored the Prince William Sound salmon drift gillnet fishery in 1990 and 1991, recording 2 mortalities in 1991, extrapolated to 29 (95% CI 1-108) kills for the entire fishery (Wynne et al. 1992). No mortalities were observed during 1990 for this fishery (Wynne et al. 1991), resulting in a mean kill rate of 14.5 (CV = 1.0) animals per year for 1990 and 1991. In 1990, observers boarded 300 (57.3%) of the 524 vessels that fished in the Prince William Sound salmon drift gillnet fishery, monitoring a total of 3,166 sets, or roughly 4% of the estimated number of sets made by the fleet. In 1991, observers boarded 531 (86.9%) of the 611 registered vessels and monitored a total of 5,875 sets, or roughly 5% of the estimated sets made by the fleet (Wynne et al. 1992). The Alaska Peninsula and Aleutian Islands salmon drift gillnet fishery was also monitored during 1990 (roughly 4% observer coverage) and no Steller sea lion mortalities were observed. It is not known whether these incidental mortality levels are representative of the current incidental mortality levels in these fisheries.

An observer program for the Cook Inlet salmon set and drift gillnet fisheries was implemented in 1999 and 2000, in response to the concern that there may be significant numbers of marine mammal injuries and mortalities that occur incidental to these fisheries. The observer coverage during both years was approximately 2-5%; precise coverage figures will be available when the contract report is provided to NMFS in 2001. There were no mortalities of marine mammals observed in either 1999 or 2000 (NMFS, unpublished data). Because information from observer programs is substantially more reliable than information from self-reported data, NMFS has removed the reference to self-reported data for these fisheries from Table 2b and will rely on the 1999-2000 observer program data as an accurate reflection of the level of Steller sea lion mortality in this fishery.

Combining the mortality estimates from the Bering Sea and Gulf of Alaska groundfish trawl and Gulf of Alaska longline fisheries presented above (9.6 + 0.6 + 1.2 = 11.4) with the mortality estimate from the Prince William Sound salmon drift gillnet fishery (14.5) results in an estimated mean annual mortality rate in the observed fisheries of 25.9 (CV = 0.6) sea lions per year from this stock.

Table 2a. Summary of incidental mortality of Steller sea lions (western U. S. stock) due to commercial fisheries from 1990 through 2001 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from self-reported fisheries information. Data from 1997 to 2001 (or the most recent 5 years of available data) are used in the mortality calculation when more than 5 years of data are provided for a particular fishery. n/a indicates that data are not available. * Data from the 1999 Cook Inlet observer program are preliminary. **Note: mortality from GOA groundfish longline in 2000 apparently now assigned to the BSAI groundfish longline; need to confirm with analyst 11/03.**

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSAI) groundfish trawl	~~97-01~~ **98-02**	obs data	62-~~77~~**80**%	~~6,~~ 6 8 6 7 11 **3**	~~10,~~ 9 9 7 11 **3**	**8.8** **(CV = xxx)** ~~9.6~~ ~~(CV = 0.10)~~
Bering Sea/Aleutian Is. (BSAI) groundfish longline	**98-02**	**obs data**	**average over 5 yrs = 32.6%**	**0.4**	**0.74**	**0.74**
Gulf of Alaska (GOA) groundfish trawl	~~96-00~~ **98-02**	obs data	**xxx** ~~33-55%~~	~~0,~~ 0 1 0 0 **0**	~~0,~~ 0 3 0 0 **0**	**1.41** **(CV = xxx)** ~~0.6~~ ~~(CV = 0.6)~~
~~GOA groundfish longline (incl. misc. finfish and sablefish fisheries)~~	~~97-01~~	~~obs data~~	~~11-14%~~	~~0, 0, 0, 1, 0~~	~~0, 0, 0, 6, 0~~	~~1.2~~ ~~(CV = 0.9)~~
Prince William Sound salmon drift gillnet	90-91	obs data	4-5%	0, 2	0, 29	14.5 (CV = 1.0)
Prince William Sound salmon set gillnet	90	obs data	3%	0	0	0
Alaska Peninsula/Aleutian Islands salmon drift gillnet	90	obs data	4%	0	0	0
Cook Inlet salmon set gillnet*	99-00	obs data	2-5%	0, 0	0, 0	0
Cook Inlet salmon drift gillnet*	99-00	obs data	2-5%	0, 0	0, 0	0
Observer program total						~~25.9~~**25.5** (CV = ~~0.64~~**recalculate**)
				Reported mortalities		
Alaska Peninsula/Aleutian Islands salmon set gillnet	90-~~01~~**02**	self reports	n/a	0, 1, 1, 1, n/a n/a, n/a, n/a, n/a, n/a**, n/a**	n/a	[$0.75]
Bristol Bay salmon drift gillnet	90-~~01~~**02**	self reports	n/a	0, 4, 2, 8, n/a n/a, n/a, n/a, n/a, n/a, n/a**, n/a**	n/a	[$3.5]

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Prince William Sound set gillnet	90-~~01~~02	self reports	n/a	0, 0, 2, 0, n/a n/a, n/a, n/a, n/a, n/a, n/a, **n/a**	n/a	[$0.5]
Alaska miscellaneous finfish set gillnet	90-~~01~~02	self reports	n/a	0, 1, 0, 0, n/a n/a, n/a, n/a, n/a, n/a, n/a, **n/a**	n/a	[$0.25]
Alaska halibut longline (state and federal waters)	90-~~01~~02	self reports	n/a	0, 0, 0, 0, 1 n/a, n/a, n/a, n/a, n/a, n/a, **n/a**	n/a	[$0.2]
Alaska sport salmon troll (non-commercial)	93-~~01~~02	strand	n/a	0, 0, 0, 0, 1, 0, n/a, n/a, n/a, **1**	n/a	[$0.2]
Minimum total annual mortality						~~$31.5~~30.9 (CV = ~~0.64xxx~~)

An additional source of information on the number of Steller sea lions killed or injured incidental to commercial fishing operations is the self-reported fisheries information required of vessel operators by the MMPA. Some incidental takes of sea lions reported in the Gulf of Alaska fisheries were listed as "unknown species", indicating the animals could have been either Steller or California sea lions. Based on all logbook reports for both species within the Gulf of Alaska, California sea lions represented only 2.2% of all interactions. Thus, the reports of injured and killed "unknown" sea lions were considered to be Steller sea lions. During the period between 1990 and ~~2001~~2002, fisher self-reports from 6 unobserved fisheries (see Table 2a) resulted in an annual mean of 5.4 mortalities from interactions with commercial fishing gear. However, because logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. These totals are based on all available self-reports for Alaska fisheries, except the groundfish trawl and longline fisheries in the Bering Sea, Aleutian Islands, and Gulf of Alaska, and the Prince William Sound salmon drift gillnet fishery for which observer data were presented above. The Bristol Bay salmon drift gillnet and set gillnet fisheries accounted for the majority of the reported incidental take in unobserved fisheries. Logbook data are available for part of 1989-1994, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-95 phase-in period is fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 7 for details).

Strandings of Steller sea lions entangled in fishing gear or with injuries caused by interactions with gear are another source of mortality data. During the 5-year period from ~~1997 to 2000~~**1998 to 2002,** the only **confirmed** fishery-related Steller sea lion (western stock) stranding was reported in 1998 in Whittier; the animal was entangled in a large flasher/spoon, but the incident is not considered a serious injury. ~~August of 1997 in Prince William Sound. The animal had troll gear in its mouth and down its throat (considered a serious injury; see Angliss and DeMaster 1998).~~ It is likely that this mortality occurred as a result of a sport fishery, not a commercial fishery (Table 2a). There are sport fisheries for both salmon and shark in this area; there is no way to distinguish between them since both fisheries use a similar type of gear (J. Gauvin, Groundfish Forum, Inc., pers. comm.). There was evidence of incidental fishery interactions with two stranded Steller sea lions in 1998; there have been no such incidences in stranding records from 1999 to 2002. Additional information on the nature of the fishery interactions is not currently available. Fishery-related strandings during ~~1997-01~~**1998-02** result in an estimated annual mortality of 0.2 animals from this stock. This estimate is considered a minimum because not all entangled animals strand and not all stranded animals are found or reported. **Steller sea lions reported in the stranding database as shot are not included in this estimate, as they likely result from animals struck and lost in the Alaska Native subsistence harvest.**

NMFS studies using satellite tracking devices attached to Steller sea lions suggest that they rarely go beyond

the U.S. Exclusive Economic Zone into international waters. Given that the high-seas gillnet fisheries have been prohibited and other net fisheries in international waters are minimal, the probability that Steller sea lions are taken incidentally in commercial fisheries in international waters is very low. NMFS concludes that the number of Steller sea lions taken incidental to commercial fisheries in international waters is insignificant.

The minimum estimated mortality rate incidental to commercial fisheries is ~~1.5~~30.9 sea lions per year, based on observer data (~~25.9~~25.5) and self-reported fisheries information (5.4) or stranding data (0.2) where observer data were not available. No observers have been assigned to several fisheries that are known to interact with this stock (self-reported data from these fisheries are provided in Table 2a), making the estimated mortality a minimum estimate.

Subsistence/Native Harvest Information

The 1992-~~96~~02 subsistence harvest of Steller sea lions in Alaska was estimated by the Alaska Department of Fish and Game, under contract with the NMFS (Table 2b: Wolfe and Mishler 1993, 1994, 1995, 1996, 1997; Wolfe and Hutchinson-Scarbrough 1999; Wolfe et al. 2002; J. Fall, ADF&G, pers. comm). In each year, data were collected through systematic interviews with hunters and users of marine mammals in approximately 2,100 households in about 60 coastal communities within the geographic range of the Steller sea lion in Alaska. **The great majority (approximately 99%) of the statewide subsistence take was from the western U. S. stock and the majority (79%) of this take was by Aleut hunters in the Aleutian and Pribilof Islands.** ~~Approximately 43 of the interviewed communities lie within the range of the western U. S. stock. The majority (79%) of sea lions were taken by Aleut hunters in the Aleutian and Pribilof Islands. A summary of the subsistence harvest of Steller sea lions from the western U. S. stock are provided in Table 2b. The great majority (approximately 99%) of the statewide subsistence take was from the western U. S. stock.~~ The mean annual subsistence take from this stock over the 4-year period from **1998 to 2002** was ~~176~~181 sea lions. The reported average age-composition of the harvest in 2001 was 42% adults, 39% juveniles, 1% pups, and 18% unknown age. The reported average sex composition of the harvest was approximately 58% males, 19% females, and 22% of unknown sex.

Other Mortality

Illegal shooting of sea lions was thought to be a potentially significant source of mortality prior to the listing of sea lions as "threatened" under the U.S. Endangered Species Act (ESA) in 1990. Such shooting has been illegal since the species was listed as threatened. (Note: the 1994 Amendments to the MMPA made intentional lethal take of any marine mammal illegal except for subsistence take by Alaska Natives or where imminently necessary to protect human life). Records from NMFS enforcement indicate that there were 2 cases of illegal shootings of Steller sea lions in the Kodiak area in 1998, both of which were successfully prosecuted (NMFS, Alaska Enforcement Division). There have been no cases of successfully prosecuted illegal shootings between 1999 and 2002 (NMFS, Alaska Enforcement Division; **confirm 2002 information**).

Table 2b. Summary of the subsistence harvest data for the western U. S. stock of Steller sea lions, 1992-01. Brackets indicate that the 1996 data remain in dispute and the 1997 data are preliminary. Subsistence harvest data were not collected in 1999 **and 2002 data are preliminary report should be available by mid-December**. Source: Wolfe et al. 2002**, J. Fall, ADF&G, pers. comm**.

Year	Estimated total number taken	95% confidence interval	Number harvested	Number struck and lost
1992	549	452-712	370	179
1993	487	390-629	348	139
1994	416	330-554	336	80
1995	339	258-465	307	32
1996	[179]	[158-219]	[149]	[30]

Year	Estimated total number taken	95% confidence interval	Number harvested	Number struck and lost
1997	[164]	[129-227]	[146]	[18]
1998	178	137-257	131	47
2000	164	121-244	141	22
2001	198	162-282	156	42
2002	**185**	**not calculated**	**144**	**41**
Mean annual take ~~1997-01~~**1998-02**	~~176~~ **181**			

STATUS OF STOCK

The current annual level of incidental mortality (~~31.5~~**30.9**) exceeds 10% of the PBR (21) and, therefore, cannot be considered insignificant and approaching a zero mortality and serious injury rate. Based on available data, the estimated annual level of total human-caused mortality and serious injury (~~31.5~~**30.9** + ~~176~~**181** = ~~208~~**212**) is below the PBR level (211) for this stock. The western U. S. stock of Steller sea lion is also currently listed as "endangered" under the ESA, and therefore designated as "depleted" under the MMPA. As a result, the stock is classified as a strategic stock. However, given that the population is declining for unknown reasons that are not explained by the level of direct human-caused mortality, there is no guarantee that limiting those mortalities to the level of the PBR will reverse the decline.

A number of management actions have been implemented since 1990 to promote the recovery of the western U. S. stock of Steller sea lions including 3 nautical mile (nmi) no-entry zones around rookeries, prohibition of groundfish trawling within 10-20 nmi of certain rookeries, and spatial and temporal allocation of Gulf of Alaska pollock total allowable catch. More recent modifications began in 1999 and continued into 2002, including reductions in removals of Atka mackerel within areas designated as critical habitat in the central and western Aleutian Islands, greater temporal dispersion of the Atka mackerel harvest, further temporal and spatial dispersal of the Bering Sea and Gulf of Alaska pollock and cod fisheries, closure of the Aleutian Islands to pollock trawling, and expansion of the number and extent of buffer zones around sea lion rookeries and haulouts.

Habitat Concerns

The unprecedented decline in the western U. S. stock of Steller sea lion caused a change in the listing status of the stock from "threatened" to" endangered" under the U. S. Endangered Species Act of 1973. There is currently no sign that the population decline since 1990 has slowed or stopped. Many theories have been suggested as causes of the decline, (overfishing, environmental change, disease, killer whale predation, etc.) but it is not clear what factor or factors are most important in causing the decline. However, competition for food, perhaps in conjunction with commercial fisheries, is a hypothesis currently receiving serious attention.

NMFS developed a Biological Opinion (BO) on the groundfish fisheries in the Bering Sea/Aleutian Islands and Gulf of Alaska regions in 2000. In this BO, NMFS determined that the continued prosecution of the groundfish fisheries as described in the Fishery Management Plan for Bering Sea/Aleutian Islands Groundfish and in the Fishery Management Plan for Gulf of Alaska Groundfish is likely to jeopardize the continued existence of the western population of Steller sea lion and to adversely modify critical habitat. NMFS also identified several other factors which could contribute to the decline of the population, including a shift in a large scale weather regime and predation. To avoid jeopardy, NMFS identified a Reasonable and Prudent Alternative that included components such as 1) adoption of a more precautionary rule for setting "global" harvest limits, 2) extension of 3 nmi protective zones around rookeries and haulouts not currently protected, 3) closures of many areas around rookeries and haulouts to 20 nmi, 4) establishment of 4 seasonal catch limits inside critical habitat and two seasonal releases outside of critical habitat, and

5) establishment of a procedure for setting limits on removal levels in critical habitat based on the biomass of target species in critical habitat.

NMFS completed a draft Supplemental Environmental Impact Statement (SEIS) in September 2000 for the groundfish fisheries in the Bering Sea Aleutian Islands and the Gulf of Alaska. Based on the potential for indirect interactions between the groundfish fisheries and Steller sea lions, northern fur seals, and harbor seals, NMFS determined that the current practices involved in the management of the groundfish fishery in Alaska "may have adverse impacts on the western U. S. stock of Steller sea lions, northern fur seals in the Bering Sea, and both the GOA and western stocks of harbor seals". However, the SEIS was determined to be incomplete in a Federal District Court ruling and remanded back to NMFS for further development.

In 2001, NMFS developed a new SEIS to consider the impacts on Steller sea lions of different management regimes for the Alaska groundfish fisheries. A committee composed of 21 members from fishing groups, processor groups, Alaska communities, environmental advocacy groups, and NMFS representatives met to recommend conservation measures for Steller sea lions and to develop a "preferred alternative" for the SEIS. Although consensus was not reached, a "preferred alternative" was identified and included in the SEIS. The preferred alternative included complicated, area-specific management measures (e.g., area restrictions and closures) designed to reduce direct and indirect interactions between the groundfish fisheries and Steller sea lions, particularly in waters within 10 nmi of haulouts and rookeries. The suit of conservation measures actually implemented in 2002 were developed after working with the: 1) State of Alaska to explore whether there are potential adverse effects of state fisheries on Steller sea lions, and 2) the North Pacific Fishery Management Council to further minimize overcapitalization of fisheries and concentration of fisheries in time and space. In addition, NMFS has agreed to revise the existing recovery plan for Steller sea lions, and is working towards the development of a co-management agreement with Alaska Native organizations for subsistence harvest of the western stock of Steller sea lions.

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Revised ~~5/1/03~~11/1/03

NORTHERN FUR SEAL (*Callorhinus ursinus*): Eastern Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Northern fur seals occur from southern California north to the Bering Sea (Fig. 5) and west to the Okhotsk Sea and Honshu Island, Japan. During the breeding season, approximately 74% of the worldwide population is found on the Pribilof Islands in the southern Bering Sea, with the remaining animals spread throughout the North Pacific Ocean (Lander and Kajimura 1982). Of the seals in U. S. waters outside of the Pribilof Islands, approximately 1% of the population is found on Bogoslof Island in the southern Bering Sea and on San Miguel Island off southern California (NMFS 1993). Northern fur seals may temporarily haul out onto land at other sites in Alaska, British Columbia, and on islets along the coast of the continental United States, but generally do so outside of the breeding season (Fiscus 1983).

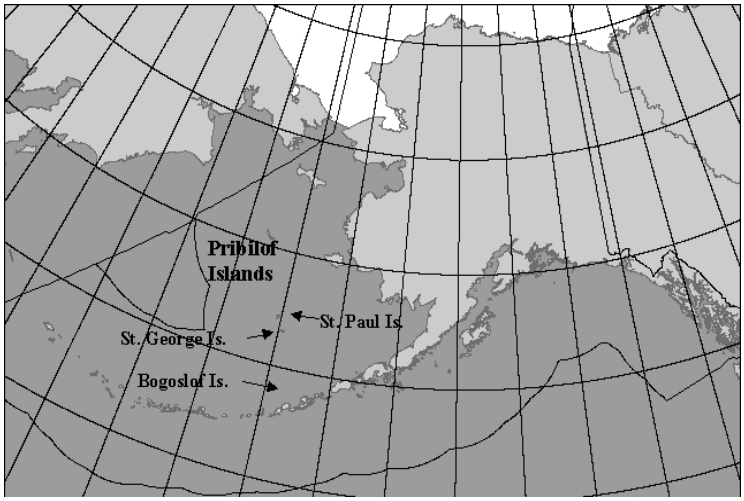

Figure 5. Approximate distribution of northern fur seals in the eastern North Pacific (shaded area).

Due to differing requirements during the annual reproductive season, adult males and females typically occur ashore at different, though overlapping times. Adult males usually occur on shore during the 4-month period from May-August, though some may be present until November (well after giving up their territories). Adult females are found ashore for as long as 6 months (June-November). Following their respective times ashore, seals of both genders then migrate south and spend the next 7-8 months at sea (Roppel 1984). Adult females and pups from the Pribilof Islands migrate through the Aleutian Islands into the North Pacific Ocean, often to the Oregon and California offshore waters. Many pups may remain at sea for 22 months before returning to their rookery of birth. Adult males generally migrate only as far south as the Gulf of Alaska **in the eastern North Pacific** (Kajimura 1984) **and the Kuril Islands in the western North Pacific (Loughlin et al 1999)**. There is considerable interchange of individuals between rookeries.

The following information was considered in classifying stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution is continuous during feeding, geographic separation during the breeding season, high natal site fidelity (**Baker et al. 1995;** DeLong 1982); 2) Population response data: substantial differences in population dynamics between Pribilof and San Miguel Islands (DeLong 1982, DeLong and Antonelis 1991, NMFS 1993); 3) Phenotypic data: unknown and 4) Genotypic data: ~~unknown~~ **little evidence of genetic differentiation among breeding islands in the Bering Sea (Ream 2002)** . Based on this information, two separate stocks of northern fur seals are recognized within U. S. waters: an Eastern Pacific stock and a San Miguel Island stock. The San Miguel Island stock is reported separately in the Stock Assessment Reports for the Pacific Region.

POPULATION SIZE

The population estimate for the Eastern Pacific stock of northern fur seals is calculated as the estimated number of pups at rookeries multiplied by a series of different expansion factors determined from a life table analysis to estimate the number of yearlings, 2 year olds, 3 year olds, and animals at least 4 years old (Lander 1981). The resulting population estimate is equal to the pup count multiplied by 4.5. The expansion factor is based on a sex and age distribution estimated after the harvest of juvenile males was terminated. Currently, CVs are unavailable for the expansion factor. As the great majority of pups are born on the Pribilof Islands, pup estimates are concentrated on these islands, though additional counts are made on Bogoslof Island. Since 1990, pup counts have occurred biennially on St. Paul and St. George Islands, although less frequently on Sea Lion Rock and Bogoslof Island (Table 5a). The

most recent estimate for the number of fur seals in the Eastern Pacific stock, based on an average of counts from 1998, 2000, and 2002 is approximately 888,120 (4.5 × 197,360).

Minimum Population Estimate

A CV(N) that incorporates the variance due to the correction factor is not currently available. Consistent with a recommendation of the Alaska Scientific Review Group (SRG) and recommendations contained in Wade and Angliss (1997), a default CV(N) of 0.2 was used in the calculation of the minimum population estimate (N_{MIN}) for this stock (DeMaster 1998). N_{MIN} is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the population estimate (N) of 888,120 and the default CV (0.2), N_{MIN} for the Eastern Pacific stock of northern fur seals is 751,714.

	Haulout location				
Year	**St. Paul**	**Sea Lion Rock**	**St. George**	**Bogoslof**	**Total**
1992[1]	182,437 (8,919)	10,217 (568)	25,160 (707)	898 (N/A)	218,712 (0.041)
1994	192,104 (8,180)	12,891 (989)	22,244 (410)	1,472 (N/A)	228,711
1996[2]	170,125 (21,244)	12,891 (989)	27,385 (294)	1,272 (N/A)	211,673 (0.10)
1998[3]	179,149 (6,193)	12,891 (989)	22,090 (222)	5,096 (33)	219,226 (0.029)
2000[4]	158,736 (17,284)	12,891 (989)	20,176 (271)	5,096 (33)	196,899 (0.089)
2002[4,*]	145,701 (1,629)	8,098 (191)	17,060 (527)	5,096 (33)	175,955 (0.010)

[1] Incorporates the 1990 est for Sea Lion Rock and the 1993 count for Bogoslof Is.
[2] Incorporates the 1994 est. for Sea Lion Rock and the 1995 count for Bogoslof Is.
[3] Incorporates the 1994 est. for Sea Lion Rock and the 1997 est. for Bogoslof Is.
[4] Incorporates the 1994 est. for Sea Lion Rock and the 1999 est. for Bogoslof Is.
[*] Preliminary data from 2002

Table 5a. Estimates and/or counts of northern fur seal pups born on the Pribilof Islands and Bogoslof Island. Standard errors and the CV for haulout locations and the total abundance estimate, respectively, are provided in parentheses.

Current Population Trend

The Alaska population of northern fur seals increased to approximately 1.25 million in 1974 after the killing of females in the pelagic fur seal harvest was terminated in 1968. The population then began to decrease with pup production declining at a rate of 6.5-7.8% per year into the 1980s (York 1987). By 1983 the total stock estimate was 877,000 (Briggs and Fowler 1984). Annual pup production on St. Paul Island ~~has~~ remained relatively stable between 1981 and 1995~~6~~ (Fig. 6a)~~, indicating that stock size has not changed much in recent years~~ (York and Fowler 1992). **There has been a decline in pup production on St. Paul Island**

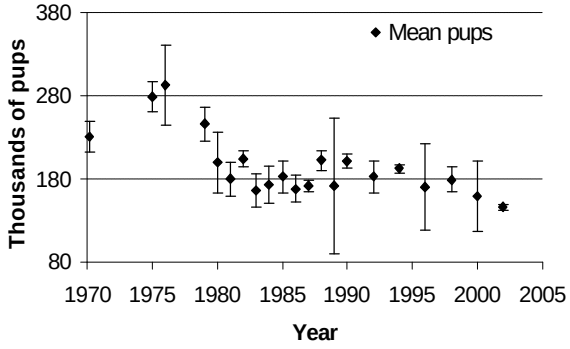

Figure 6b: Estimated number of northern fur seal pups born on St. Paul Island, 1970-02 **(new graphic)**.

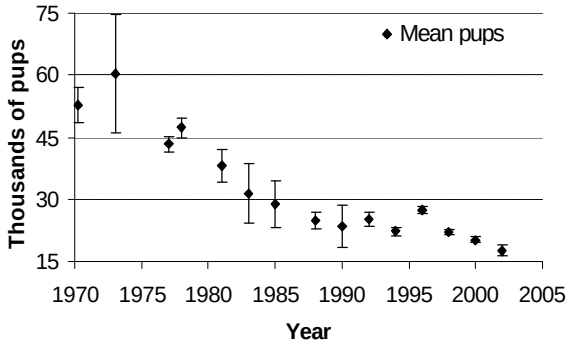

Figure 6b. Estimated number of northern fur seal pups born on St. George Island, 1970-02 **(new graphic)**.

since the mid-1990s. ~~The 1996 estimate of number of pups born on St. Paul Island is not significantly different from the 1990, 1992, or 1994 estimates (York et al. 1997). However, the 2000 estimate of the number of pups born was 10% less than the 1992 count and 6% less than the 1996 count.~~ Although there was a slight increase in the number of pups born on St. George Island in 1996, the number of pups born declined between 1996 and 1998, and the 1998 counts were similar to those obtained in 1990, 1992, and 1994 (Fig. 6b). During 1998-02, pup production declined 5.14% per year (SE = 0.26%) on St. Paul Island and 5.35% per year (SE = 0.19%) on St. George Island (A. York, pers. communication, October 2002). Counts in both 2000 and 2002 were lower than previous years; the estimated pup production is now below the 1921 level on St. Paul Island and below the 1916 level on St. George Island.

The northern fur seal was designated as "depleted" under the Marine Mammal Protection Act (MMPA) in 1988 because population levels had declined to less than 50% of levels observed in the late 1950s and there was no compelling evidence that carrying capacity (K) had changed substantially since the late 1950s (NMFS 1993). Under the MMPA, this stock will remain listed as depleted until population levels reach at least the lower limit of its optimum sustainable population (estimated at 60% of K).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The northern fur seal population increased steadily during 1912-24 after the commercial harvest no longer included pregnant females. During this period, the rate of population growth was approximately 8.6% (SE = 1.47) per year (A. York unpubl. data, National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115), the maximum recorded for this species. This growth rate is similar and slightly higher than the 8.12% rate of increase (approximate SE = 1.29) estimated by Gerrodette et al. (1985). Though not as high as growth rates estimated for other fur seal species, the 8.6% rate of increase is considered a reliable estimate of R_{MAX} given the extremely low density of the population in the early 1900s.

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized MMPA, the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 0.5, the value for depleted stocks under the MMPA (Wade and Angliss 1997). Thus, for the Eastern Pacific stock of northern fur seals, PBR = 16,162 animals (751,714 × 0.043 × 0.5).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

The NMFS estimate of the total number of northern fur seals killed incidental to both the foreign and the joint U. S.-foreign commercial groundfish trawl fisheries in the North Pacific from 1978 to 1988 was 246 (95% CI: 68 - 567), resulting in an estimated mean annual rate of 22 northern fur seals (Perez and Loughlin 1991). The foreign high seas driftnet fisheries also incidentally killed large numbers of northern fur seals, with an estimated 5,200 (95% CI: 4,500 - 6,000) animals taken during 1991 (Larntz and Garrott 1993). These estimates were not included in the mortality rate calculation because the fisheries are no longer operative, although some low level of illegal fishing may still be occurring. Commercial net fisheries in international waters of the North Pacific Ocean have decreased significantly in recent years. The assumed level of incidental catch of northern fur seals in those fisheries, though unknown, is thought to be minimal (T. Loughlin, pers. comm., National Marine Fisheries Service).

Six different commercial fisheries in Alaska that could have interacted with northern fur seals were monitored for incidental take by fishery observers during 1990-01: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries, and Gulf of Alaska groundfish trawl, longline, and pot fisheries. The only observed fishery in which incidental mortality occurred was the Bering Sea and Aleutian Islands groundfish trawl (Table 5), with a mean annual (total) mortality of 1.5 (CV = 0.63). In 1990 and 1991, observers monitored the Prince William Sound salmon drift gillnet fishery and recorded no mortalities of northern fur seals. In 1990, observers boarded 300 (57.3%) of the 524 vessels that fished in the Prince William Sound salmon drift gillnet fishery, monitoring a total of 3,166 sets, or roughly 4% of the estimated number of sets made by the fleet (Wynne et al. 1991). In 1991, observers boarded 531 (86.9%) of the 611 registered vessels and monitored a total of 5,875 sets, or roughly 5% of the estimated sets made by the fleet (Wynne et al. 1992). During 1990, observers also boarded 59 (38.3%) of the 154 vessels participating in the Alaska

Peninsula/Aleutian Islands salmon drift gillnet fishery, monitoring a total of 373 sets, or roughly 4% of the estimated number of sets made by the fleet (Wynne et al. 1991). Although no interaction with northern fur seals was recorded by observers in 1990 and 1991 in these fisheries, due in part to the low level of observer coverage, mortalities did occur as recorded in fisher self-reports (see Table 5b).

An additional source of information on the number of northern fur seals killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During the period between 1990 and 1999, fisher self-reports from three unobserved fisheries (see Table 5b) resulted in an annual mean of 14.5 mortalities from interactions with commercial fishing gear. While logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994), the bias in these estimates are hard to quantify because at least in one area (Prince William Sound), it is unlikely that fur seals occur and reports of fur seal-fishery interactions are likely the result of species misidentification. The great majority of the incidental take in fisher self-reports occurred in the Bristol Bay salmon drift net fishery. In 1990, self-reports from the Bristol Bay set and drift gillnet fisheries were combined. As a result, some of the northern fur seal mortalities reported in 1990 may have occurred in the set net fishery. Logbook data are available for part of 1989-1994, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-95 phase-in period is fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 7 for details).

Table 5b. Summary of incidental mortality of northern fur seals (Eastern Pacific stock) due to commercial fisheries from 1990 through ~~2001~~**2002** and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from self-reported fisheries information. Data from 1997 to ~~2001~~**2002** (or the most recent 5 years of available data) are used in the mortality calculation when more than 5 years of data are provided for a particular fishery. n/a indicates that data are not available.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Islands groundfish trawl	~~97-01~~ **98-02**	obs data	53-74%	~~0~~ 1 1 0 1 **0**	~~0~~ 4 2 1 2 **0**	~~1.5~~**1.2** (CV = ~~0.63~~**xxx**)
Observer program total						~~1.5~~**1.2** (CV = ~~0.63~~**xxx**)
				Reported mortalities		
Prince William Sound salmon drift gillnet	90-~~01~~**02**	self reports	n/a	1, 1, 0, 0, n/a, n/a, n/a, n/a, n/a, n/a, n/a, n/a, n/a, **n/a**	n/a	[$0.5]

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Alaska Peninsula/Aleutian Islands salmon drift gillnet	90-~~01~~02	self reports		2, 0, 0, 0, n/a, n/a, n/a, n/a, n/a, n/a, n/a, n/a, **n/a**	n/a	[$0.5]
Bristol Bay salmon drift gillnet	90-~~01~~02	self reports	n/a	5, 0, 49, 0, n/a, n/a, n/a, n/a, n/a, n/a, n/a, n/a, **n/a**	n/a	[$13.5]
Minimum total annual mortality						$~~16.2~~**15.7** (CV = ~~0.63~~**xxx**)

No observers have been assigned to several of the gillnet fisheries that are known to interact with this stock, making the estimated mortality unreliable. However, the large stock size makes it unlikely that unreported mortalities from those fisheries would be a significant source of mortality for the stock. The estimated minimum annual mortality rate incidental to commercial fisheries is 17 fur seals per year based on observer data (1.2), and self-reported fisheries information (16) where observer data were not available.

Entanglement studies on the Pribilof Islands are another source of information on fishery-specific entanglements. Based on entanglement rates and sample sizes presented in Zavadil et al. (2003), an average of 1.1 fur seals/year on the rookeries was entangled in pieces of trawl netting and an average of 0.1 fur seal/year was entangled in monofilament net.

Anecdotal reports of northern fur seals entangled in fishing gear or with injuries caused by interactions with gear are another source of mortality data. During the 5-year period from 1998-02 the only fishery-related northern fur seal stranding was reported in September 2001 near Unalaska as entangled in 8" poly trawl web. The animal was cut free and was apparently healthy.

Subsistence/Native Harvest Information

Alaska Natives residing on the Pribilof Islands are allowed an annual subsistence harvest of northern fur seals, with a take range determined from annual household surveys. ~~From 1986 to 1996, the annual subsistence harvest level averaged 1,412 and 193 for St. Paul and St. George Islands, respectively, for a total of 1,605. The subsistence harvest levels from 1997 to 2001 were 1,380, 1,558, 1,193, 750, and 781. The average subsistence harvest level for 1997-01 is 1,132.~~ **The subsistence harvest levels from 1998-02 were 1,297, 1000, 747, 597, and 648 (Cormany 1999, Lestenkof and Zavadil 2001; Zavadil and Lestekof 2003), for an average annual subsistence harvest of 857.8**. Only juvenile males are taken in the subsistence harvest, which likely results in a much smaller impact on population growth than a harvest of equal proportions of males and females. A few females (~~3 in 1996, 3 in 1997, and~~ 5 in 1998**, 1 in 2000, need to check Cormany report for 02 data)** were accidentally taken. Subsistence take in areas other than the Pribilof Islands is known to occur, though believed to be minimal (NMFS unpubl. data, National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115).

Other Mortality

Intentional killing of northern fur seals by commercial fishers, sport fishers, and others may occur, but the magnitude of this mortality is unknown. Such shooting has been illegal since the species was listed as "depleted" in 1988. (Note: the 1994 Amendments to the MMPA made intentional lethal take of any marine mammal illegal except for subsistence hunting by Alaska Natives or where imminently necessary to protect human life).

Mortality resulting from entanglement in marine debris has been implicated as a contributing factor in the decline observed in the northern fur seal population on the Pribilof Islands during the 1970s and early 1980s (Fowler 1987, Swartzman et al. 1990**; Fowler 2002**). Surveys conducted from 1995 to 1997 on St. Paul Island indicate a rate of entanglement among subadult males comparable to the 0.2% rate observed from 1988 to 1992 (Fowler and Ragen 1990, Fowler et al. 1994), which is lower than the rate of entanglement (0.4%) observed during 1976-85 (Fowler et al. 1994). ~~During 1995-97, NMFS researchers in conjunction with members of the Aleut communities of St. Paul and St. George Islands captured and removed entangling debris (including trawl net, packing bands, twine, and miscellaneous items) from 88, 146 and 87 northern fur seals, respectively.~~ **Between 1995 and 2000, responsibility for entanglement studies of northern fur seals shifted gradually from NMML to the Tribal Government of St. Paul's Ecosystem Conservation Office (ECO). ECO has managed the entanglement studies under a co-management agreement with NOAA for northern fur seals since 2000. Entanglement rates of male northern fur seals on St. Paul from 1998-02 were 0.2, 0.26, 0.25, 0.3, and 0.37 (Zavadil et al., 2003). The recent rates of entanglements are close to those recorded in the mid-1980s; however, recent changes in methodology (counting juvenile males vs all males) make direct comparisons between recent and historical data difficult (Zavadil et al. 2003). In 2002, the composition of entangling debris switched from predominantly packing bands to trawl net fragments (Zavadil et al. 2003).**

STATUS OF STOCK

Based on currently available data, the minimum estimated fishery mortality and serious injury for this stock (17) is less than 10% of the calculated PBR (1,790) and, therefore, can be considered to be insignificant and approaching a zero mortality and serious injury rate. The estimated annual level of total human-caused mortality and serious injury (17 + ~~1,132~~**858** = ~~1,149~~**875**) is not known to exceed the PBR (16,162) for this stock. The Eastern Pacific stock of northern fur seal is classified as a strategic stock because it is designated as "depleted" under the MMPA. The Alaska SRG has noted that the multiplier used to convert pup counts to total population size is likely negatively biased and that the estimate of the current population size using the existing multiplier is only marginally less than 60% of the best available estimate of K (DeMaster 1996). Therefore, the Alaska SRG has recommended that the NMFS undertake research to evaluate the degree to which the currently used multiplier may be biased, and if necessary, consider re-evaluating the status of this stock relative to carrying capacity.

Habitat Concerns

Recent rapid development on the Pribilof Islands increases the potential for negatively affecting habitat used by northern fur seals. Associated with the development on the islands comes the nearshore discharge of seafood processing waste, oil and contaminant spills, increased direct human disturbance, and increased levels of noise and olfactory pollution. Preliminary data suggest that the development on St. Paul Island may be impacting fur seal rookeries as pup production has declined on two of the three rookeries in closest proximity to human habitation and to the sewer and processor outfalls. Studies designed to assess the potential impact of human and industrial development on the Pribilofs have been planned.

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